

# The Safety and Efficacy of Color Pigments in Commerce: Industry Sustainability Practices Contrasted with Environmental Misconceptions

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# Definition of Color Pigments

- Pigments are colored, black, white or fluorescent particulate organic or inorganic solids which usually are insoluble in, and essentially physically and chemically unaffected by, the vehicle or substrate in which they are incorporated.
- Pigments alter appearance by selective absorption and/or by scattering of light.
- Pigments are usually dispersed in vehicles or substrates for application, as for instance in the manufacture of inks, paints, plastics or other polymeric materials.
- Pigments retain a crystal or particulate structure throughout the coloration process.

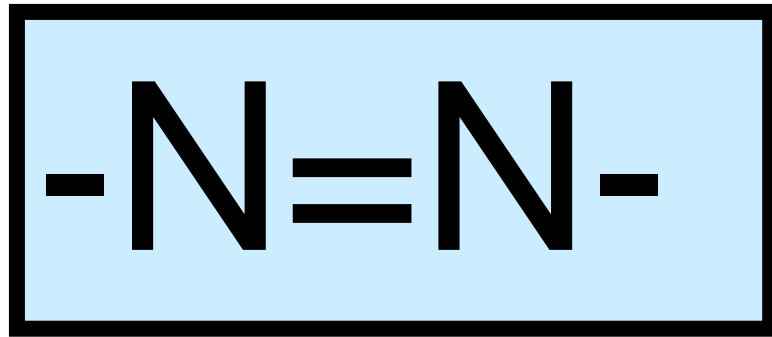
(Safe Handling of Color Pigments, Color Pigments Manufacturers Association Inc., First Edition, 1993)

# History of Color Pigments

- The late 19<sup>th</sup> century—first water insoluble pigments entered the market.
- **1905**, Toluidine Red, Pigment Red 3
- **1907**, Dinitroaniline Orange, Pigment Orange 5
- **1909**, Monoazo Yellow, Pigment Yellow 1
- **1912**, Naphtol AS pigments
- **1935**, Diarylide pigments, phthalocyanine pigments
- **1954**, Disazo condensate pigments
- **1955**, Quinacridone pigments
- **1960**, Benzimidazalone pigments
- **1964**, Isoindolinone pigments
- **1986**, Diketopyrrolo pyrrole pigments

# Basics: Color Pigments in Paints and Plastics

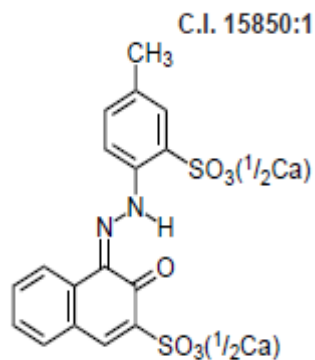
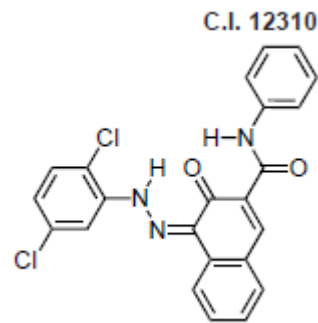
- Azo pigments are produced in almost all possible hues of yellow, orange, red, bordeaux, carmine, and brown with the demanded physical properties.
- Azo Pigments are named for the Azo Group:



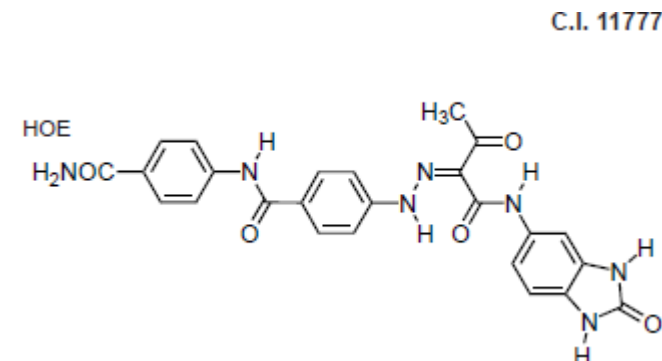
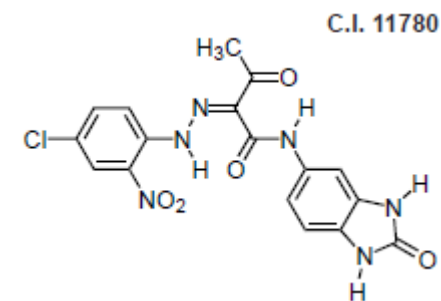
- Two Nitrogen atoms joined by a double bond.

# Azo Color Pigments in Paints & Plastics

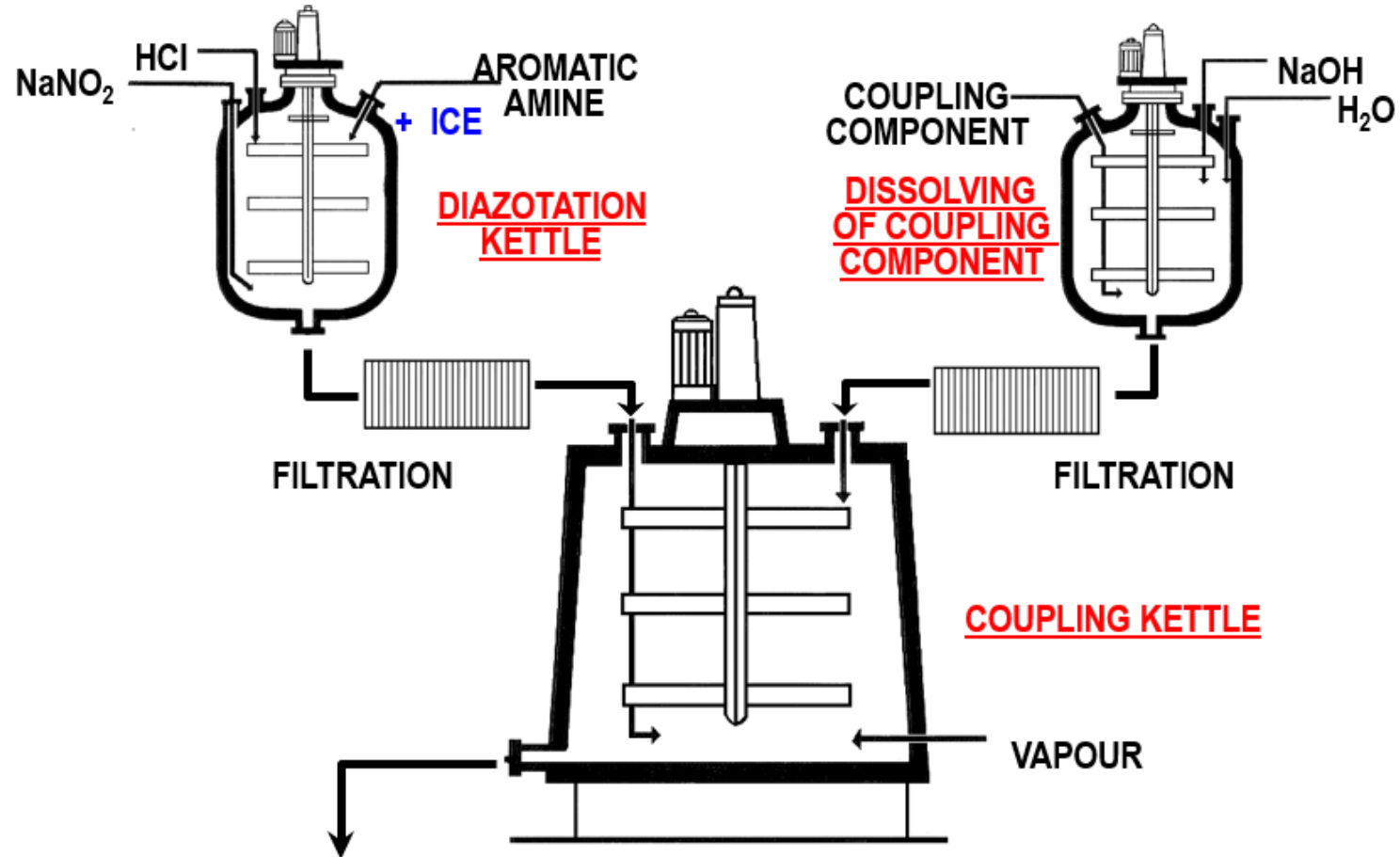
## Monoazo (examples)



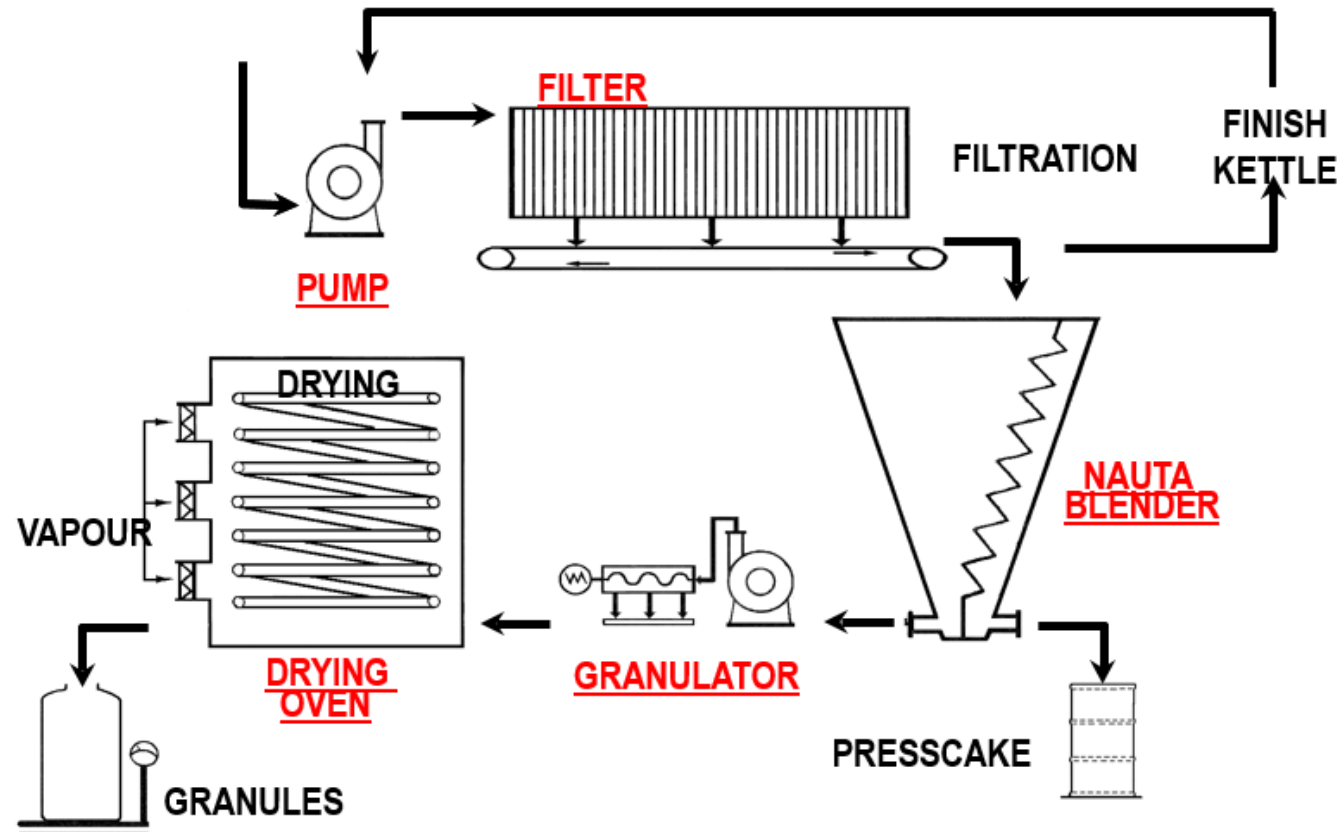
## Benzimidazolone (examples)



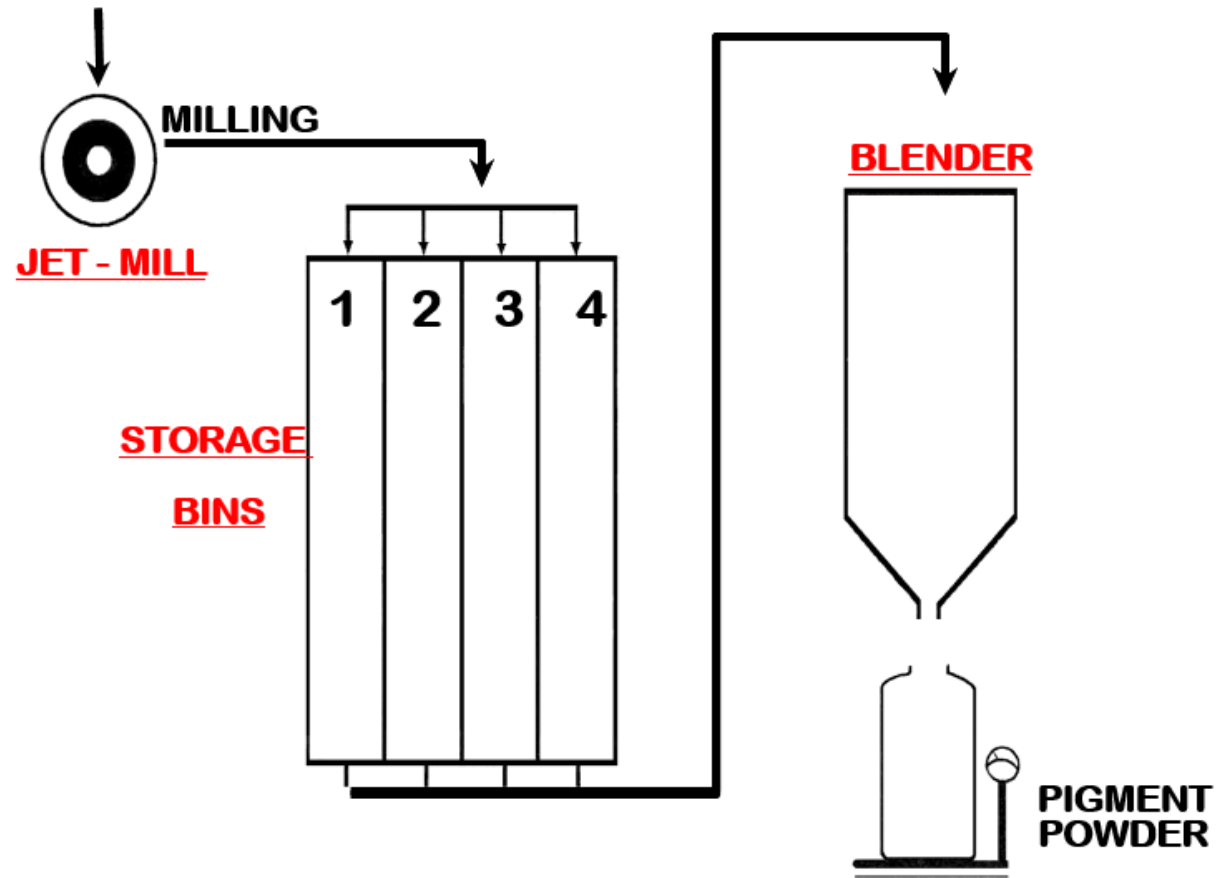
# Azo Pigment Process



# Azo Pigment Finishing



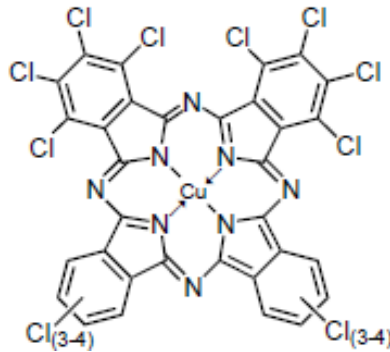
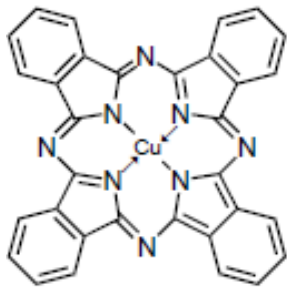
# Azo Pigment Finishing





# Other Color Pigments in Paints & Plastics

## Phthalocyanine (examples)



- Azo blue and green representatives have no commercial significance.
- Phthalocyanines provide a majority of blue and green color.

# Color Pigments Characteristics & Customer Requirements

- Chroma
  - Broad shade functionality
  - Durability/lightfastness
  - Opacity/transparency
  - Low metamerism
  - Dispersibility
  - Heat stability
  - Solvent resistance
  - Gloss retention
  - Color strength
  - Fitness for purpose (performance level)
  - Regulatory status
  - Cost
  - Availability
- Each pigment is **unique** to fit its intended use in commerce and **difficult to substitute**.

# Exposure to Color Pigments

- Inherently not bioavailable
- Virtually insoluble (as demonstrated by water and octanol partition coefficient)
- Not toxic in their intended uses
- In final use, pigments are **encapsulated** in resins of ink, coatings and plastics→ no exposure of concern and not readily bioavailable (humans, animals, and the environment)

# Organic Pigments: Tested & Used Safely in Commerce

- Used in products and in commerce for decades
  - Diarylide pigments in commerce in North America since WWII
  - Phthalocyanine pigments in commerce in North America since the late 1930's
- **Tested and safe in intended applications and continue to be used in commerce**
- Governments in US, Canada and the EU have approved the safe uses of organic pigments through extensive studies and any substitution of these safe organic pigments would have to be evaluated by the government to meet the safety levels already established

# Approved Safe Uses for Specific Pigments

- United States:
  - FDA, Food Contact
  - EPA Inerts: Seed Coatings, Consumer Products
  - EPA Safer Choice Program
- Canada:
  - Health Protection Branch, Food Contact
  - PMRA Inerts Formulants List

# Environmental Compliance

- United States
  - Toxic Substances Control Act (TSCA)
  - SARA Title III 313 Toxic Chemical Release (SARA 313)
  - Comprehensive Environmental Response Compensation and Liability Act (CERCLA)
  - Resource Conservation and Recovery Act (RCRA)
  - Occupational Safety and Health Administration (OSHA)
- Canada
  - Canadian Environmental Protection Act (CEPA)
  - National Pollutant Release Inventory (NPRI)
  - Workplace Hazardous Materials Information System (WHMIS)

# Toxicological Data & Demonstrated Safety for Diarylide Pigments

- **1978 Study of the National Toxicological Program** - no evidence of carcinogenicity for diarylide yellow in two year chronic toxicity study.
- **1990's Organisation for Economic Co-Operation and Development Screening Information Dataset Dossier** - diarylide pigments do not present a hazard to the environment due to their low hazard profile.
- **2010 Registration, Evaluation, Authorisation and Restriction of Chemicals Dossier** – safe for use in EU commerce in the pigment's indented use.

# Toxicological Data & Demonstrated Safety for Diarylide Pigments

- **2010 US EPA Benzidine Dyes Action Plan** : “In reviewing the benzidine congener-based pigments, EPA believes that the presence of pigments in such consumer products as printing inks, paints, plastics, and textiles was unlikely to present an exposure concern, because the pigments are not bioavailable and are not absorbed into the body”
- **2014 Final Canada Assessment** :”Based on the information presented in this screening assessment, it is concluded that the five diarylide yellow pigments (CAS RNs 5102-83-0, 5567-15-7, 6358-85-6, 78952-70-2 and 90268-24-9) considered in this assessment do not meet the criteria under paragraph 64(a) or (b) of CEPA 1999, as they are not entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity or that constitute or may constitute a danger to the environment on which life depends.”



# Toxicological Data and Demonstrated Safety for Phthalocyanine Pigments

- **2005 Organisation for Economic Co-Operation and Development (OECD) Screening Information Dataset Dossier** - low priority chemical due to low hazard profile.
- **2010 Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Dossier** - safe for use in EU commerce in the pigment's intended use.

# Conclusions

- Each pigment is **unique** to fit its intended use in commerce and **difficult to substitute**
- Pigments are inherently **not bioavailable**
- Pigments are **proven safe for use in commerce**
- Industry strictly **complies with regulations**

# Thank you!

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